AMENDMENTS TO THE SPECIFICATION

Please amend paragraph [0002] as follows:

[0002] Hydrogen gas is used and produced in many applications. Since the amount of hydrogen in a gas stream produced by a given process may be an indicator of system efficiency, the systems typically utilize combustible gas sensors to determine the level of hydrogen. An example of a prior art system having ~~a~~ an arrangement for monitoring combustible gas is shown in Figure 1A. The electrochemical system 12 receives water from an external source 14 and passes it through a deionizing bed 16. Once the water has been properly conditioned, it is supplied to an electrochemical cell 18 which disassociates the hydrogen and oxygen.

Please amend paragraph [0004] as follows:

[0004] A typical fuel cell uses the same general configuration as is shown in Figure 1B. Hydrogen gas is introduced to the hydrogen electrode (the anode in fuel cells), while oxygen, or an oxygen-containing ~~gas~~ gas, such as air, is introduced to the oxygen electrode (the cathode in fuel cells). Water can also be introduced with the feed gas. The hydrogen gas for fuel cell operation can originate from a pure hydrogen source, hydrocarbon, methanol, or any other hydrogen source that supplies hydrogen at a purity suitable for fuel cell operation (i.e., a purity that does not poison the catalyst or interfere with cell operation). Hydrogen gas electrochemically reacts at the anode to produce protons and electrons, wherein the electrons flow from the anode through an electrically connected external load, and the protons migrate through the membrane to the cathode. At the cathode, the protons and electrons react with oxygen to form water, which additionally includes any feed water that is dragged through the membrane to the cathode. The electrical potential across the anode and the cathode can be exploited to power an external load.

Please amend paragraph [0006] as follows:

[0006] After the electrochemical cell 18 (Figure 1A) disassociates the water, oxygen and hydrogen gas exit the cell 18 through conduits 20 and ~~22~~ 22, respectively. As mentioned herein above, in addition to the gas products, water entrained in the gases exits with the oxygen and hydrogen. The hydrogen conduit 22 typically connects with a hydrogen phase separator 24 which extracts most of the water from the gas, with the water exiting the phase separator 24 through a valving arrangement which recycles the water back into the electrochemical cell water feed conduit. Depending on the needs of the application, additional water may be removed from the hydrogen gas by passing through an optional dessicant gas dryer 26 before exiting the process for use in the application.

Please amend paragraph [0007] as follows:

[0007] The oxygen gas stream 20 also enters into a phase separator 28 with a majority of the water separating from the gas stream and dropping to the bottom of the separator 28. As with the hydrogen separator ~~24~~ 24, this water is removed via a valving arrangement 30 and recycled into the electrochemical cell water feed conduit. The separated hydrogen gas exits the phase separator 28 via a conduit 32 to exit the process. Since it is desirable to monitor for the presence of hydrogen gas in the oxygen gas stream, the oxygen phase separator 28 includes a second outlet 34 which provides a sample gas stream through an orifice 40 to a combustible gas sensor 36. A gas dryer 38, such as a NAFION tube dryer, is usually placed inline between the phase separator 28 and the sensor 36 to remove water still entrained in the gas. Unfortunately, since the gas stream can still have a relative humidity greater than ~~95%.~~ 95%, ~~This~~ this high relative humidity results in lower monitoring performance than is desired.

Please amend paragraph [0009] as follows:

[0009] Disclosed herein are systems and methods for monitoring combustible gas levels in a gas stream. In an exemplary embodiment of a system for monitoring combustible gas that comprises: a first phase separator having first outlet; a second phase separator having an inlet and at least one outlet having a opening therefrom, said second separator inlet being fluidly connected to said first separator outlet; ~~and,~~ and a first combustible gas sensor adjacent said second separator outlet, said first sensor being spaced a predetermined distance from said second separator outlet opening.

Please amend paragraph [0010] as follows:

[0010] Another embodiment includes a electrochemical system that comprises: an electrochemical cell stack having an oxygen outlet; a first phase separator having an inlet and at least one outlet, said inlet being connected to said cell stack oxygen outlet; a second phase separator having an inlet and at least one outlet having a opening therefrom, said second separator inlet being fluidly connected to said first separator outlet; ~~and,~~ and a first combustible gas sensor adjacent said second separator outlet, said first sensor being spaced a predetermined distance from said second separator outlet opening.

Please amend paragraph [0011] as follows:

[0011] Another embodiment includes a system for monitoring combustible gas comprising: a first phase separator having at least one outlet; a housing having an inlet and at least one outlet, said housing inlet being connected to said first separator outlet; ~~and,~~ and a first combustible gas sensor mounted to said first housing, said first sensor ~~sensor~~ having a sensing face being positioned generally perpendicular to said first housing inlet.

Please amend paragraph [0012] as follows:

[0012] Another embodiment for an electrochemical system ~~that~~ comprises: an electrochemical cell stack having an oxygen outlet; a first phase separator having an inlet and at least one outlet, said inlet being connected to said cell stack oxygen outlet; a housing having an inlet and at least one outlet, said housing inlet being connected to said first separator outlet; ~~and,~~ and a first combustible gas sensor mounted to said first housing, said first sensor ~~sensor~~ having a sensing face being positioned generally perpendicular to said first housing inlet.

Please amend paragraph [0013] as follows:

[0013] Another embodiment includes a system for monitoring combustible gas comprising: a gas temperature controller having an inlet and an outlet, said controller reducing the relative humidity of the gas to less than 95% relative humidity; ~~and,~~ and a combustible gas sensor coupled to said controller outlet.

Please amend paragraph [0014] as follows:

[0014] Another embodiment includes a method for monitoring the level of combustible gas comprising: injecting a gas stream into a housing; impacting said gas stream into a wall; mixing said gas stream with air; ~~and,~~ and sensing levels of combustible gas in said mixed gas stream.

Please amend paragraph [0015] as follows:

[0015] Another embodiment includes a method for monitoring the level of combustible gas comprising: separating water from a saturated gas stream in a first phase separator; flowing said gas stream through an orifice to restrict flow and decrease pressure of said gas stream; ~~and,~~ and monitoring the level of combustible gas in said gas stream.

Please amend paragraph [0016] as follows:

[0016] Another embodiment includes a method for monitoring the level of combustible gas comprising: separating water from a saturated gas stream; controlling the temperature of said gas stream to reduce the relative humidity of said gas stream; ~~and,~~ and monitoring the level of combustible gas in said gas stream.

Please amend paragraph [0025] as follows:

[0025] Figure 3 is a schematic drawing illustrating an exemplary embodiment of a system capable of detecting combustible gas in a vent stream; ~~and,~~ and

Please amend paragraph [0030] as follows:

[0030] The combustible gas sensor arrangement ~~of~~ utilized by the prior art ~~in~~ is shown in Figure 2A. In this arrangement, the CG sensor device 36 includes a CG sensor 42 and a housing 44. The housing 44 is typically tubular in shape and attaches to the sensor 42 by any convenient ~~means~~ means, such as a thread (not shown). The CG sensor 42 also includes a sensing face 43 which detects the levels of combustible gas, this face 43 is located opposite a housing open end 46. A gas sample tube 48 is inserted into the open end 46. During operation, the saturated gas stream 49 exits the sample tube 48 and mixes with the air in the housing allowing some drying of the saturated gas.

Please amend paragraph [0031] as follows:

[0031] An exemplary embodiment of the CG sensor of the present invention is shown in Figure 2B. In this embodiment, the ~~CG sensor 42~~ gas sample tube 48 is positioned a predetermined distance d from the sensor face 43. An air stream 50 is moved through the gap defined by the distance d. During operation, ~~as~~ the saturated gas stream 49 exits the sample tube 48 and mixes with the dry air stream 50 drying the gas stream 49 and reducing the relative humidity. When used inside an enclosure, the CG sensor arrangement 51 may additional benefits over the prior art when the air stream 50 is also the main ventilation path as well. This arrangement would allow the sensor arrangement to not only sense hydrogen originating from the phase separator 28, but from elsewhere in the enclosure as well.

Please amend paragraph [0032] as follows:

[0032] An alternate embodiment CG sensor arrangement of the present invention is shown in Figure 2C. This embodiment 53 is similar to that of Figure 2A, except that the CG sensor 42 is positioned above the housing 52 and is spaced from the ~~the~~ sample tube 48 vertically by a predetermined distance y. The sample tube 48 enters the housing 52 through an opening 54 preferably at an angle generally perpendicular to the sensor face 43. By sizing the distance y appropriately for a given gas flow rate, the sensor can be protected from inadvertent splashing or contamination by water from the gas stream 49. The housing 52 includes an open end 56 opposite the CG sensor 42 to allow drainage of water. During operation, the saturated gas stream 49 enters the housing 52 from the sample tube 48. In the ~~housing~~ housing, the gas stream mixes with dry air to reduce the relative humidity of the gas being monitored by the sensor 42. Since the sensor 42 is vertically above the sample tube 48, water and oxygen being heavier than air will drain away from the sensor 42 through the opening 56 while the lighter gases, such as ~~hydrogen~~ hydrogen, will mix with the air and raise to the sensor face 43. By adjusting the distance ~~d"~~ d’ between the end of the sample tube and the housing wall ~~58~~ 58, the mixing of the gas stream 49 with the dry air can be enhanced. Openings 55 may be optionally provided in the housing adjacent the sensor 42, or between the housing 52 and the sensor 42 to prevent the buildup of gas resulting in erroneous measurements by the sensor 42.

Please amend paragraph [0033] as follows:

[0033] Another alternate embodiment of the CG sensor arrangement is shown in Figure 2D. This embodiment 59 is preferable in environments where excessive amounts of water or high levels of relative humidity may be expected. In this embodiment, the sample tube enters a housing 60 and mixes with dry air to reduce the relative humidity. At least one, and preferably several, openings 62 are located vertically above the sample tube 48 and generally opposite a drain opening 66. The openings 62 can either be in the side wall (as shown in Figure 2D), or in the top of the housing 60. The openings allow the dried gas to disperse into a second housing 64 ~~is~~ installed around the first housing 60. The CG sensor 42 is coupled to the second housing 64 and is located generally above the first housing 60. As the dried gas disperses, it enables ~~to~~ the sensor 42 to monitor the levels of combustible gas. Optional holes 65 located in the second housing 64 prevent build up of gas in the second housing 64. By arranging the sensor 42 in the second housing, the sensor 42 can be protected from liquid splashing onto the sensor, while minimizing the size of the assembly.

Please amend paragraph [0034] as follows:

[0034] Referring now to FIGS. ~~3-11~~ 3-11, the four CG ~~sensors~~ sensor arrangements 36, 51, 53, 59 are arranged individually and in combination with each other and additional components to provide reduced relative humidity gas streams to the sensor 42.

Please amend paragraph [0039] as follows:

[0039] Electrodes 114 and 116 comprise ~~catalyst~~ catalysts suitable for performing the needed electrochemical reaction (i.e., electrolyzing water to produce hydrogen and oxygen). Suitable electrodes comprise, but are not limited to, platinum, palladium, rhodium, carbon, gold, tantalum, tungsten, ruthenium, iridium, osmium, and the like, as well as alloys and combinations comprising one or more of the foregoing materials. Electrodes 114 and 116 can be formed on membrane 118, or may be layered adjacent to, but in contact with or in ionic communication with, membrane 118.

Please amend paragraph [0043] as follows:

[0043] In the exemplary embodiment shown in Figure 3, a sample conduit 72 connects the phase separator 28 with a second phase separator 74. As the gas stream enters the second separator 74, additional water is removed from the gas. An optional solenoid valve 76 is connected to the phase separator 74 to allow ~~period~~ periodic draining of water for disposal, or recycling back into the electrochemical cell 18 feed loop. The separated gas in second separator 74 exits through a conduit 78, passing through an orifice 80 which reduces the pressure of the gas and restricts the flow of gas into the combustible gas sensor 36. The size of the orifice 80 will depend on the application, and the amount of flow restriction ~~is~~ desired. In ~~general~~ general, the smallest orifice that provides a minimal risk of becoming plugged is desired. In the exemplary embodiment, the preferred orifice 80 has an opening size of less and 0.025 inches, and more preferably has an opening size of less than 0.016 inches. It should be appreciated that while the phase separator 74 is illustrated as a standard phase separation device (long tubular vessel, mounted vertically), this device may also be a coalescing filter which is periodically replaced. The drop in pressure due to the orifice 80 lowers the relative humidity from near 100% when the gas enters the second separator 74 to less than 80%.

Please amend paragraph [0044] as follows:

[0044] An alternate embodiment of the phase separation and gas monitoring system 70 is shown in Figure 4. In this embodiment, the gas leaving separator 28, passes through an orifice 81, which drops the pressure and restricts the flow of gas into a second separator 74. Preferably, the orifice 81 has an opening size of less ~~and~~ than 0.025 inches, and more preferably has an opening size of less than 0.016 inches. In this configuration, since the gas in the second phase separator 74 is at a lower pressure, the second separator 74 can be drained using an orifice 82 which provides sufficient flow to prevent the second separator 74 from over-filling with water. The gas stream from the second separator 74 moves to the combustible gas sensor 36 via conduit 78. The drop in pressure due to the orifice 81 and second separator 74 lowers the relative humidity from near 100% when the gas leaves the separator 28 to less than 95% when it reaches the combustible gas sensor.

Please amend paragraph [0045] as follows:

[0045] Another alternate embodiment of the phase separation and gas monitoring system 70 is shown in Figure 5. In this embodiment, the gas leaving second separator 74 through conduit 78, passes through an orifice 80, which drops the pressure and restricts the flow of gas to the CG sensor arrangement 51. As the gas stream leaves the conduit 78, it passes through a stream of dry air 86 which further reduces the relative humidity of the gas stream as it reaches the CG sensor 42. A fan 84 either coupled to the combustible gas ~~system~~ sensor arrangement 51 or elsewhere in the system 12, provides the mechanism for creating dry air stream 86.

Please amend paragraph [0047] as follows:

[0047] Figure 7 and Figure 8 provide yet ~~another~~ other ~~embodiment~~ embodiments utilizing redundant sensors to detect the presence of combustible gas in the gas stream. In addition to improving reliability in monitoring capability, each of these embodiments utilize a different CG sensor arrangement which increases the reliability further by lowering the risk that an environmental factor (air pressure, temperature, humidity and the like) will effect both sensors simultaneously. It should be appreciated that the specific CG sensor arrangements used in the embodiments shown in Figures 7- 8 are examples, and that any combination of CG sensor arrangements described herein could be utilized to achieve the same effect.

Please amend paragraph [0048] as follows:

[0048] In the alternate embodiment shown in Figure 7, the first sensing arrangement 53 monitors the main gas stream that exits separator 28 through conduit 32. The gas stream enters the CG sensor arrangement 53 where it mixes with dry air to provide monitoring capability as described herein above. The gas stream exits the CG sensor arrangement 53 through opening 56 (Figure 2C) and vents to the atmosphere. It should be appreciated the CG sensor arrangement 53 could be positioned internally, or externally to the system 12. A second CG sensor arrangement 51 is provided through sampling conduit 72 which provides a gas stream from the phase separator 28 to a second phase separator 74 which provides further reduction in the gas ~~streams~~ stream's water content. The gas stream exits the phase separator 74 through conduit ~~78~~ 78, passes through an orifice ~~80~~ 80, and is monitored by sensor arrangement 51. As described herein above, the gas stream mixes with a dry air stream 86 which provides further reduction in the relative humidity and improvement in monitoring performance.

Please amend paragraph [0049] as follows:

[0049] The alternate embodiment in Figure 8 is arranged to also provide redundant monitoring of a sample stream. In some applications, this may provide additional benefits over the embodiment illustrated in Figure 7 in that the primary vent stream is not interrupted. In this ~~embodiment~~ embodiment, a sample conduit 72 allows the gas stream to move from the separator 28 to a second separator 74 through an orifice 81 which lowers the pressure and restricts the flow of the gas stream. In the second separator 74, additional water is removed and the gas stream exits through both conduit ~~78~~ 78, that delivers the gas stream to CG sensor arrangement ~~51~~ 51, and through conduit 88 to the CG sensor arrangement 53. It should be appreciated that similar to the embodiment in Figure 5, the orifice 81 may be positioned after the second separator 74. Additionally, instead of having two conduits exit the second separator 74, a single conduit may be used with the conduits 78, 88 branching off from the single conduit to the respective CG sensor arrangements 51, 53.

Please amend paragraph [0052] as follows:

[0052] An alternate embodiment shown in Figure 10 uses the cooling of the gas stream to condense additional water from the gas stream and thus lower the relative humidity. In this embodiment, a gas stream enters the phase separator 92 from conduit 20. The phase separator 92 is cooled by a suitable device, including but not limited to thermoelectric cooling devices, to cause water vapor in the gas stream to condense and be captured within the phase separator 92. The condensed water is removed from the separator 92 via valve arrangement 30 and either recycled, or similarly disposed of. The gas stream exits the phase separator 92 via conduit 72 through an orifice 80 which lowers the pressure and restricts the flow of the gas stream. The gas exits the conduit 72 into the CG sensor arrangement 36. While the embodiment illustrated in Figure 10 shows the cooling device coupled with a single or primary phase separator, other arrangements would be equally effective including the addition and cooling of a second subsequent phase separator. Depending on the application, the cooling of a second phase separation may be preferable since it may reduce the amount of cooling necessary to achieve the desired final relative humidity. Additionally, while the CG sensor arrangement 36 is illustrated, any of the CG sensor arrangements 51, 53, 59 described herein may be used in this arrangement.